Report of Preliminary Findings: Stratigraphy, Structure and Metamorphic Petrology of the Turner Lake Area, N.W.T.

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Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

EGS 1991-9 Report of Preliminary Findings: Stratigraphy, Structure, and Metamorphic Petrology of the Turner Lake area part of NTS 76 N/2 AND 76 N/3 by Susan Schaan

1 text, 8 pages

Price: $0.40

92-00374/

Report of Preliminary Findings: Stratigraphy, Structure and Metamorphic Petrology of the Turner Lake Area, N.W.T.

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The Archean Hood River Greenstone Belt (HRB) (Jefferson et al., 1991) west of Bathurst Inlet, N.W.T. is located in the northeastern Slave Structural Province. A map area near Turner Lake measuring approximately 8 X 11 km was chosen for a detailed study as part of a Master's thesis at the University of Ottawa. This area is well constrained; it is bordered on the north by the James River, on the east by Turner Lake and to the west and south by granitoid plutons. Mapping completed in this study area will be included in a compilation map of work completed across the entire Hood River Belt. This work will be compiled with other mapping completed across the belt (Henderson et al., 1991). Discussion here is limited to the Turner Lake area.

The homoclinal supracrustal sequence dominated by metasedimentary rocks has been metamorphosed to regional amphibolite grade and intruded by granitoid and related pegmatite bodies and late Archean diabases. Proterozoic dykes are the youngest rocks. Four stratigraphic units constitute the laterally extensive supracrustal sequence. From the base, these are: (Unit 1) greywacke to mudstone turbidites; (Unit 2) conglomerate (James Falls Conglomerate) (Roscoe et al., 1988); (Unit 3) a stratigraphically complex sequence of intercalated conglomerates, arenites, gabbroic to dioritic bodies, volcanic and volcaniclastic rocks; (Unit 4) greywacke to mudstone turbidites. The thin to medium bedded turbidites are located on the eastern and western margins of the map area with Units 2 and 3 forming a central belt.

Unit 1 greywacke to mudstone turbidites in the western part of the study area provide sedimentary younging data from graded bedding (greywacke to mudstone). The majority of tops

indicators are to the east in the frequently overturned beds. Greywacke is the predominant lithology and quartz veins are rare. Toward the upper contact of this unit with the overlying conglomerate, psammite predominates over pelite.

Bedding (S0) in Unit 4 turbidites on the eastern side of the map area are typically enhanced by quartz stringers. Sedimentary younging data is predominantly eastward. Thin (less than 50 cm) beds of silicate facies iron formation, typically garnetite (4a), are present in these turbidites west of Turner Lake.

The polymict James Falls Conglomerate (Unit 2), forms an angular unconformity with the underlying Unit 1. Rounded to well-rounded granule to boulder-sized clasts include variable proportions of volcaniclastic, porphyritic volcanic and sedimentary rock types. Some rusty sub-rounded (up to 6 cm) clasts found in the southwest part of the study area could be eroded from iron formation. The conglomerate matrix is sandstone, similar in composition to the underlying Unit 1. The clasts are identical in character to many of the supracrustal rock units of the belt and are interpreted to be of local derivation. In many cases the sedimentary rock clasts are only faintly distinguishable from the matrix. At the falls on the James River the conglomerate has a minimum thickness of 170 m (Jefferson et al., 1990, Fig. 9) and clasts are flattened into vertically ellipsoidal pancakes. Unit 2 is exposed almost continuously along the western margin of the central arenite-volcanic sequence (Unit 3) within this study area. There are some discontinuities and folds of Unit 2 in the southwestern part of the map area.

Unit 3 is a stratigraphically complex sequence of intercalated volcanic, intrusive and clastic rocks, forms a central belt in the map area. The following discussion and lettering of sub-units is not necessarily in stratigraphic order. Rusty weathering quartz-rich, muscovite, fibrolite, andalusite $\pm$ cordierite bearing feldspathic arenites (3b) lie stratigraphically above, below, and are

intercalated with volcanic, volcaniclastic and conglomeratic rocks. The feldspar content of these rocks averages about 10% and increases near the contact with conglomerates to about 25%. The arenites are cross bedded and fine planar laminated and contain no pelite. A shallow water depositional environment transitional to a turbidite basin has been inferred. Lenses of conglomerate similar to the James Falls conglomerate are dispersed within this sequence. Local breccias (3h) are volcanic-clast dominated and in places are monomict volcanic breccia of felsic to mafic composition where these rocks are found in contact with the overlying Unit 4 metasedimentary rocks. Local conglomerate of felsic volcanic clasts in an amphibole matrix has been noted at the main showing at the contact between epiclastic mafic tuffs and metadiorite/gabbro. Volcaniclastic rocks (3a) locally contain quartz eyes and subrounded quartz and feldspar rocks clasts. Bimodal volcanism is indicated by alternating bands up to a few cm wide of mafic and felsic volcanic rock (3g). Mafic bands are hornblende rich whereas felsic bands contain clinopyroxene. Mafic tuffs are volcanic, typified by graded bedding (3e) or epiclastic units containing thin mm to cm sized laminations (3f). Metabasalt (3c) usually has a pitted weathered surface and contains pyroxene phenocrysts in an amphibole matrix. Talc-rich varieties of the mafic volcanic rocks could be ultramafic flows or sills. No diagnostic textures or structures have survived metamorphism and deformation. Metagabbroic/dioritic rocks (3d) outcrop as map-scale discrete lenses and as bedding-parallel sheets which are too small to be mapped as distinct units. The fabric elements of the metagabbro/diorite are identical to those in the surrounding rocks. Their intrusion is considered to be contemporaneous with volcanism.

Gold has been the target of exploration at Turner Lake since 1964 with the discovery of visible gold by George Turner and Noel Avadluk, prospectors for Roberts Mining Company. This prospect is stratabound (not statiform) hosted in a sulphidic, amphibolitic, fine-grained

clastic host unit (3i) on the north limb of a vertically plunging, eastward-closing macroscale late fold in Unit 3. This open fold is attenuated in the Unit 4 metasedimentary rocks to the east and terminated abruptly to the west along an intensely foliated zone which trends 020. The gold is present as visible gold associated with quartz veins in the clastic host unit. Disseminated gold has been noted within the host matrix (G. Walton, pers. comm.)

Two granitoid plutons intrude the supracrustal sequence: the very weakly foliated, Fish-hook Lake biotite, muscovite monzogranite (FHLG) and the variably foliated Pistol Lake biotite granodiorite (PLG). The PLG is more strongly foliated than the FHLG, particularly on its margins, but this is still considered to be a weak to moderate fabric. Only the margins of PLG have been examined in this study. A late syn to post kinematic emplacement has been inferred. At least two phases of pegmatite are associated with the plutons. Apatite-, tourmaline- and muscovite-bearing lithium-enriched pegmatites are most abundant near the FHLG.

The above Archean rocks are intruded by three mafic dyke swarms. The oldest diabases are east-west dark green dykes with plagioclase megacrysts and have been dated at 2692 $\pm$ 80 Ma (Gates and Hurley, 1973). Outcrop relationships suggest these are younger than the pegmatites and so the mafic dykes must be younger than plutonism. The N-NW trending Proterozoic Mackenzie diabase dykes have a badelleyite U-Pb age of 1267 $\pm$ 2 Ma (Lecheminant and Heaman, 1989). The youngest diabase is a Franklin dyke which outcrops east of Turner Lake as a sill-like body. Franklin emplacement has been dated using badelleyite at 723 $\pm$ 3 Ma (Heaman et al., 1990). An olivine gabbro plug west of Turner lake intrudes Unit 4.

The supracrustal rocks preserve primary depositional structures, two generations of tectonic fabrics and three generations of folds have been identified. Macroscopic slump folds, first generation folds, are present in Unit 1 metasedimentary rock stratigraphically below the

James Falls Conglomerate. Bedding and other primary depositional fabrics such as trough cross bedding and grading are recognizable in Units 1, 3 and 4. Bedding is frequently overturned with steep to vertical dips toward the west in the east-facing homoclinal succession. Locally, as at the main showing, sedimentary younging directions are to the west. Examination of drill core from the main showing (TP87-9) shows a reversal in tops from uphole to downhole within the Unit 4 metasedimentary rocks. Tops in outcrops on the north limb of the fold are to the north and east suggesting isoclinal folding in this area. The regional tectonic fabric is a mineral foliation, labelled S1 trending NE, clockwise to bedding which trends NNE. Locally as in the vicinity of the main showing, S1 is crenulated by S2, a mineral crenulation trending ENE. S1, where crenulated, is transposed into a bedding parallel orientation. Where parallel to S0, S1 is emphasized by quartz stringers particularly in Unit 4. Cordierite and andalusite porphyroblasts are elongate along S1. Cordierite porphyroblasts in Unit 4 have been found which preserve the pre-crenulated S1 fabric. Where cordierite and andalusite overgrowths are found together S1 is deformed around the cordierite and is preserved in the andalusite. This alignment and overgrowth indicates that peak metamorphism occurred during late D1 to early D2 (pre-crenulation). The fabric within the James Falls conglomerate and similar conglomerate clasts reflects the regional metamorphic fabric S1. The clasts are elongate parallel to this fabric. No clasts with pre-F1 fabrics have been found and therefore the clasts do not represent a much older basement. Unit 3 mafic tuffs (3e, 3f) preserve metre-scale disharmonic folds with vertical, or nearly vertical fold hinges (F1). An intensely foliated zone transects the map area and Unit 3.

Metamorphic grade is uniform across the area and is marked by the low pressure regional-scale amphibolite facies assemblage cordierite $\pm$ andalusite $\pm$ sillimanite (fibrolite) in the metasedimentary rocks. Retrograde reactions include biotite to chlorite with rutile needles

exsolved in biotite (sagenitic texture).

The plutonic and volcanic rocks of the map area are being dated using U-Pb zircon geochronology as part of an ongoing mapping project of the entire belt by the Geological Survey of Canada. The writer has assisted in the production of the first two preliminary results: a sheared plutonic rock has been dated at 2607 $\pm$ 1.3 Ma and the PLG has been dated at 2600 + 2.2/- 2.0 Ma (van Breemen, pers. comm.). The dating will be used in this project to establish temporal relationships of units within this belt and relate the Hood River belt to adjacent belts of the Slave Province in terms of Slave Province evolution.

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